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THE IMPACT OF PUBLIC DEBT SERVICE ON ECONOMIC GROWTH: EMPIRICAL EVIDENCE FROM ZAMBIA

Talknice Saungweme¹ and Nicholas M. Odhiambo²

Abstract

This study contributes to the existing public debt service-economic growth nexus by examining the impact of public debt service on economic growth in Zambia using time-series method, covering the period from 1970 to 2017. The study employs the autoregressive distributed lag (ARDL) bounds analysis technique, which permits the simultaneous estimation of the long- and short-run model parameters. Overall, the empirical results reveal that the impact of government debt service on economic growth, in Zambia, is time-variant. Whereas the neutrality of public debt service on economic growth is confirmed in the long run, in the short run the relationship is negative. To achieve macroeconomic stability and realise sustainable economic growth rates, the paper recommends that the Zambian government, among other things, undertake active fiscal consolidation to ensure that debt repayments do not cause excessive budget overruns and are not financed from new debt; and continuously improve public debt management strategies and policies to smoothen the government debt redemption profile.

Keywords: Public debt service, economic growth, Zambia, ARDL

JEL Classification: H63, O47

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1. Introduction

Despite repeated analysis by numerous researchers, the debt-growth debate is still ongoing, and the results have been inconclusive. Most recently, the World Bank (2019) stated that the rising cost of public debt service in sub-Saharan African countries will impact negatively on economic growth. Public debt service is projected to rise, and in some countries, breach the indicative sustainability threshold levels beginning 2022 (International Monetary Fund “IMF”, 2017a). The rising cost of public debt service in this region is in part due to “.... bullet repayments falling due on maturing international bond issues, coupled with rising global interest rates....” (World Bank, 2019: 11). The International Monetary Fund (2017a) alluded that excessive exchange rate movements, massive built-up of new debts and high global and domestic interest rates are likely to destabilise most world economies in the foreseeable future.

In literature, the avenues through which sovereign debt affects economic growth have differed depending on the variances in the structure and composition of the debt, structure of fiscal institutions and also in the structure of the economies (see Clements *et al.*, 2003). Further, the effect of public debt, particularly on low-income economies, has been determined by whether the country is a net recipient of resource transfers from the international community or not (see also Clements *et al.*, 2003). According to Feldstein (1986: 4), the economic problem of servicing debts increases remarkably when a debtor country is no longer receiving any financial support from the donor community. Despite these country variations, high debt stocks and huge repayment burdens have resulted in permanent fiscal crisis and heavy administrative burdens in most world economies (see Presbitero, 2005).

Similar to most sub-Saharan African countries, Zambia’s rising public debt stock has been accompanied by significant changes in both domestic and foreign borrowing patterns, as well as changes in government debt repayment profile, especially after 2012 (Bank of Zambia, 2017, World Bank, 2019, IMF, 2017b). According to the Bank of Zambia (2017: 15), foreign public debt service accounted the most on the decline in foreign exchange reserves. The central bank added that the decline in gross international reserves was moderated by the bank’s net foreign exchange purchases from the market, amounting to US\$402.6 million in December 2017 (Bank of Zambia, 2017: 15). On the whole, during the period from 2008 to 2017, there has been a remarkable increase in government bond issuance and syndicated loans – which has changed Zambia’s debt maturity profile (Bank of Zambia, 2017). By end of 2017, the debt sustainability analysis of Zambia indicated that the country’s public sector debt vulnerabilities had increased tremendously, breaching the generally accepted indicative thresholds (IMF,

2017b). The government debt repayment risk of Zambia is also envisaged to be unsustainable beginning 2022 when most Eurobond payments fall due (IMF, 2017b).

Thus, in view of the current global economic and financial environment, governments should set up long-term debt management frameworks that permit a steady and sustainable economic growth. Also, to avoid the reversal of the gains from concessionary borrowings, public debt service costs need to be monitored and maintained within growth enhancing levels (see IMF, 2017a; International Bank for Reconstruction and Development, 2017). Against this background – where the previous studies on public debt service on economic growth have not been consistent, and where the Zambian public debt service costs are souring following high public debt levels – the objective of this study is to empirically examine the impact of public debt service on economic growth in Zambia during the period from 1970 to 2017, using an autoregressive distributed lag (ARDL) bound testing methodology. The study aims to take the public debt service-economic growth debate a step closer to its conclusion as well as proffer policy recommendations to the relevant policy makers in Zambia.

This study contributes to the existing public debt-economic growth literature in two notable ways. First, unlike previous studies that focused largely on the impact of aggregate public debt on economic growth, this study extends the debate to the linkage between public debt service and economic growth. There are fears that Zambia may be using new loans to facilitate public debt servicing, which may not effectively promote its ostensible developmental purpose (see Saungweme and Odhiambo, 2018). Second, the study estimates both the long-run and short-run impact of public debt service on economic growth using one of the most developed econometric technique, the ARDL procedure. The chosen approach has numerous strengths over other traditional estimation methods used in most previous studies. For instance, the ARDL testing procedure yields robust results even in small or finite data sample sizes, unlike the Engle and Granger (1987) test and the Full-Maximum Likelihood (FML) test which are responsive to the sample magnitude (Pesaran *et al.*, 2001).

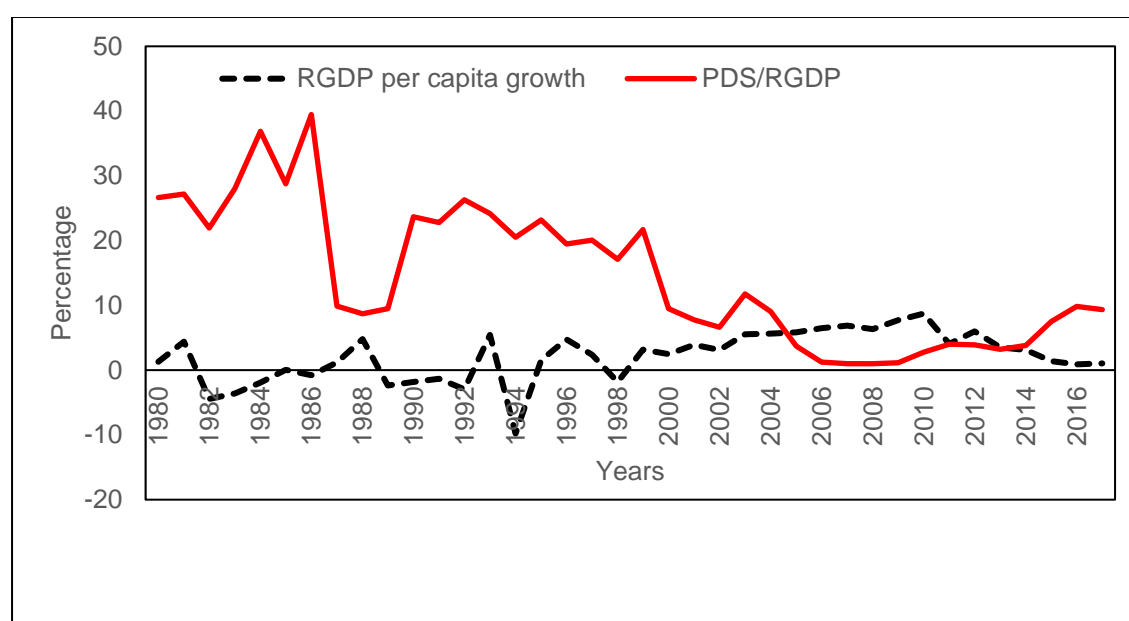
The remaining part of the paper proceeds as follows: Section II analyses the trends in public debt service and economic growth in Zambia. Section III surveys the debt service-growth literature. The study methodology is dealt with in Section IV. Section V presents the empirical analysis, while the conclusion and the policy suggestions are given in Section VI.

II. Public debt service and economic growth in Zambia: An outline

As the stock of public debt was increasing in Zambia since the 1970s, so was the cost of servicing that debt. The cumulative impact of world economic crisis and plummeting international copper prices, as well as the swift rises in world interest rates in the mid-1970s resulted in an unsustainable debt burden and an upsurge in poverty levels in Zambia (World Bank, 2017a). Disproportionate public debt repayment costs during the period from 1975 to 2000 directly reduced government budgetary allocations on social services – such as health and education – and on productive sectors (World Bank, 2004). Although the net debt service burden was reduced in 2006, following the massive debt relief to the country, service costs started to rise again after 2012. For instance, in 2013, 9% of domestic revenues were channelled towards public debt interest payments, and in 2017 this had risen to 25% (Ministry of Finance “MOF”, 2017).

The increase in the cost of servicing government debt beginning 2015 was compounded by both the increase in the size of the bonds and the rise in coupon rate – which increased from 5.4% in 2012 to 8.5% in 2014 and further to 9.0% in 2015 (MOF, 2017). Government foreign debt repayments alone increased by 53.3% to US\$585.0 million, from US\$381.7 million in 2015, and further to US\$666.7 million in 2017 (Bank of Zambia, 2017). As reported by the International Bank for Reconstruction and Development (2017: 9), public debt service costs in Zambia constituted 47% of the total foreign currency outflows between January and August 2017. Figure 1 shows the annual growth rate of gross domestic product (GDP) per capita and public debt service-to-real GDP ratio in Zambia, covering the period 1980 – 2017.

Figure 1: Trends in public debt service and economic growth in Zambia (1980-2017)



Source: Authors' computations based on World Bank (2017b; 2019) databank

In Figure 1, the link between government debt service and economic growth rate appears to be negative. Sovereign debt repayments, according to the IMF (2001), inescapably exert economic growth constraints on debtor countries since they involve huge outflows of financial resources to the creditors. As can be seen in Figure 1, three distinct periods of debt service can be identified; 1980 to 2005, 2006 to 2013 and 2014 to 2017. Between 1980 and 2005, public debt service outlays exceeded the country's pace of economic growth resulting in depressed growth prospects, which placed the country in a high debt risk category (Government of the Republic of Zambia, 2006; IMF, 2005). In 1987, the government made a resolution to put a cap on foreign debt repayments, hence the noticeable abrupt fall in PDS/RGDP ratio between 1987 and 1990 (World Bank 1993: 60). Again, the sharp drop in the PDS/RGDP ratio in 2000 and 2005 is credited to debt forgiveness by both private and multilateral creditors (IMF and International Development Agency, 2001; IMF, 2005).

Following the massive public debt relief in 2005, there was an improvement in economic performance and a substantial reduction in public debt service costs as shown in Figure 1. In the period after 2014, however, the negative impact of rising debt repayments on economic growth can be clearly seen in Figure 1. During the period 2015 - 2017, government expenditure on public debt interest payments constituted 3.9%, 3.5% and 4.1% of GDP in 2015, 2016 and 2017, respectively, against 2.8%, 2.2% and 2.0% of GDP spent on goods and services (Bank of Zambia, 2017). Henceforth, Zambia's liquidity risk jumped upwards and economic

growth rates deteriorated. According to IMF (2017b), Zambia issued Eurobonds in 2012, 2014 and 2015, which will mature beginning 2022. The associated bullet repayments on these Eurobonds starting 2022 is likely to further result in a protracted breach of the baseline debt sustainability indicative thresholds.

III. A synopsis of theoretical and empirical literature

The theoretical literature on the relationship between public debt service and economic growth is largely explained by the debt overhang hypothesis (see Sachs, 1989; Krugman, 1988). The hypothesis asserts that a public debt service burden is ruinous to economic growth through tax uncertainties and huge financial resource outflows to the creditors (Kalemli-Özcan *et al.*, 2017; Cohen, 1995). The compounding effect of the tax uncertainties and the costly institutional and revenue reforms discourage new long-term investments and encourages massive capital flight – leading to depressed investment and lower economic growth rates (see, for example, Zhili, 2016; Mangır and Sawhney, 2014; Krugman, 1988; Diamond, 1965). Diamond (1965) argues that domestic public debt repayments can lead to a substitution of government debt for private sector investments. Thus, the public debt-overhang hypothesis posits that government debt service costs cause disastrous budgetary and domestic liquidity constraints which bring about misallocation of capital and deterrence to long-term private investment (see Elbadawi *et al.*, 1997; Cohen, 1993; Bowen *et al.*, 1960; Buchanan, 1958).

According to Borensztein (1990) and Fry (1989), high foreign public debt servicing costs compel authorities to engage in inflationary financing techniques, such as excessive money printing and currency devaluation, to meet rising demand for foreign currency (see also, Claessens *et al.*, 1996; Buchanan, 1958). If the debtor country is unable to consistently settle its eternal financial obligations when they fall due, two possibilities arise – either to contract new debt, or to seek debt forgiveness (Sachs, 1990; Krugman, 1988). This scenario was referred to by Krugman (1988) as the trade-off between government debt financing and forgiveness.

From an empirical outlook, the relationship between government debt service and economic growth has generated mixed evidence for the debt-overhang conception (see among others, Balcilar, 2012; Reinhart *et al.*, 2012; Presbitero, 2005; Clements *et al.*, 2003). Furthermore, most previous studies have been centred on the impact of foreign debt service on economic growth (see, among other studies, Pattillo *et al.*, 2002; 2004; Clements *et al.*, 2003, and Elbadawi *et al.*, 1997).

Empirical studies that have a strong backing for the debt-overhang supposition affirm that debt repayments create future tax uncertainty, perpetuate financial resource outflows leading to liquidity constraints, and increases new issuance of government securities (Balcilar, 2012; Pattillo *et al.*, 2011; Patenio and Tan-Cruz 2007; Clements *et al.*, 2003; Sachs 1989; Krugman 1988). The compounding effects of these outcomes are credit rationing, high costs of capital, and limited participation of the private sector in developmental issues (Balcilar, 2012; Aizenman *et al.*, 2007; Cohen, 1993). This view is further supported empirically by Serieux and Samy (2001) and Weeks (2000).

A few other studies, however, claim that public debt service has no influence on economic growth, stating that debt-financed expenditures enhance the payment of taxes to service the debt (Buchanan, 1958). The empirical work which is related to this view includes Pattillo *et al.* (2002) and Hansen (2001). Conclusively, based on previous empirical studies, the evidence of the direct impact of public debt service on economic growth remains unclear.

IV Methodology

Theoretical and empirical underpinnings of the study model

In literature, several proxies for economic growth have been used and among them are real gross domestic product, real gross national product, GDP per capita, and GDP growth rate. The dependent variable in this study is annual growth rate of real GDP per capita, a proxy for economic growth rate. Annual growth rate of real GDP per capita is calculated as the ratio of real GDP to the average population of a specific year (World Bank, 2017b). According to Mankiw (2013), the annual growth rate of real GDP per capita is a good proxy for economic growth because it provides a summary of output performance and is a standard indicator of welfare. A rise in per capita GDP reflects an increase in productivity, which signals growth in the economy and welfare (Mankiw, 2013). The choice of this proxy for economic growth is also based on numerous previous empirical works including, for example, Eberhardt (2017), Eberhardt and Presbitero (2015), and Kourtellos *et al.* (2013).

Following the theoretical public debt overhang hypothesis and its crowding out effect, the rate of economic growth is assumed to be affected by public debt payments and other various factors (see Kumar and Woo, 2010; Sachs, 1989). Public debt service, defined as the ratio of the public debt payments to real GDP, constitutes all financial outlays by the government in lieu of contracted monetary contingency obligations (IMF, 2003). The

transmission mechanism through which public debt service affect economic growth is multifold. This include a reduction on the available financial resources for public sector investment (Krugman, 1988); a change in the manner in which labour and capital are exploited in the production process (Cunningham, 1993), and the adoption of inflationary policies, such as seigniorage, by the government (Agénor and Montiel, 1999).

While the theoretical literature on the relationship between public debt service and economic growth is largely negative, the empirical evidence is inconclusive. The debt overhang theories argue that public debt service crowds out economic growth by depressing private savings and private investment, as well as deterring potential foreign investors (Hansen, 2002; Serieux and Samy, 2001; Cohen; 1993). However, a few other past studies have found no correlation between these two macroeconomic variables (Akram, 2016; 2015; Jalles, 2011).

In addition to the annual growth rate of real GDP per capita (y) and public debt service (PDS), six additional variables were added to the model. These variables are gross fixed capital formation as a share of real GDP (a proxy for investment (I)), the ratio of economically active population, aged between 15 and 64 years, to total population (a proxy for labour (L)), fiscal balance as a share of real GDP (a proxy for fiscal balance (FB)), trade openness, defined as imports plus exports to real GDP ratio (a proxy for trade openness (TOP)), gross domestic savings as a share of real GDP (a proxy for savings (S)), and terms of trade (TOT).

Investment is among the dominant factors of economic growth, supported theoretically, by both exogenous and endogenous economic growth models (see Lucas, 1988; Romer, 1986; Solow, 1956). Increased capital investment not only enhances labour productivity but increases both production efficiency and production capacity of the economy (see, among others, Delong and Summers, 1991). Among the previous empirical studies that found a positive relationship between investment and economic growth is Bist (2018) and Narayan and Narayan (2013). Thus, as investment increases, the study expects the economy to also grow.

Apart from investment, labour is considered as another pillar of economic growth in theoretical literature because of its direct impact on productivity and technical progress (Minami, 1964). However, the net impact of labour on economic growth is varied across studied countries depending on the proxy used (see, for example, Bist, 2018). Based on the above argument, labour is predicted to be positively related to economic growth.

The third control variable in the study model is fiscal balance. According to the World Bank (2007: 74), fiscal balance can enhance economic growth if a country engages in both prudent budget planning and efficient tax administration. The correlation between fiscal balances and economic growth may also be positive if public expenditures are channelled towards the financing of physical capital accumulation, education and health care (see, for example, Afonso *et al.*, 2006; Adams and Bevan, 2005). Accordingly, fiscal balance is, in this study, expected to positively affect economic growth.

The fourth determinant of economic growth in this study is trade openness. Trade openness grants a country access to new technology, new financial and capital resources through exports, imports and investment flow, which are vital for development processes (Menyah *et al.*, 2014; Yanikkaya, 2003). This study, therefore, expects trade openness to significantly influence economic growth in a positive way.

The economic growth path of a country is also depended on the level of national savings, (see, for example, Sinha and Sinha, 1998). Traditional theories of economic growth, such as Solow (1956), Lucas (1988) and Romer (1986), emphasise the role of savings in the accumulation of physical capital, and hence, view savings as being at the heart of economic growth. Savings are, therefore, expected in this study to positively influence the rate of economic growth.

Finally, theoretical literature regards terms of trade as another key driver of economic growth (Grossman and Helpman, 1991). According to Grossman and Helpman (1991), a rise in terms of trade increases access to modern technology and capital goods (see also Blattman *et al.*, 2003). This variable was used in other past empirical studies such as in Checherita-Westphal (2010), and Kumar and Woo (2010). The coefficient of terms of trade is expected in this study to be positive.

Estimation techniques, data and empirical model specification

In this analysis, the autoregressive distributed lag (ARDL) testing approach is employed to scrutinise the underlying relationship between public debt service and economic growth in Zambia. The ARDL test procedure is preferred in this study over other substitute econometric techniques due to its strength to estimate concurrently the long-run and short-run coefficients of the model, among other reasons (see Chirwa and Odhiambo, 2017; Odhiambo, 2009; Pesaran *et al.* 2001). The study uses annual time-series data covering the period 1970 –

2017, that is, 48 observations. Sample selection was based on two major reasons, that is, the starting period coincides with major economic, financial and public debt reforms, and the chosen period has consistent quality time-series data for all the chosen variables. The data for all variables was sourced from the World Bank Development Indicators (World Bank, 2017b).

Following the theoretical arguments brought about by the neoclassical (Jorgensen, 1967), exogeneous (Solow, 1956; Swan, 1956) and endogenous (Romer, 1986; Lucas, 1988) growth models, and the earlier empirical studies (see among others, Spilioti and Vamvoukas, 2015; Abbas and Christensen, 2010), the ARDL growth equation in this study can be expressed as follows:

$$\begin{aligned}\Delta y_t = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta y_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta PDS_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta I_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta L_{t-i} \\ & + \sum_{i=0}^n \beta_{5i} \Delta FB_{t-i} + \sum_{i=0}^n \beta_{6i} \Delta TOP_{t-i} + \sum_{i=0}^n \beta_{7i} \Delta S_{t-i} + \sum_{i=0}^n \beta_{8i} \Delta TOT_{t-i} \\ & + \phi_1 y_{t-1} + \phi_2 PDS_{t-1} + \phi_3 I_{t-1} + \phi_4 L_{t-1} + \phi_5 FB_{t-1} + \phi_6 TOP_{t-1} + \phi_7 S_{t-1} \\ & + \phi_8 TOT_{t-1} + \mu_{1t} \dots \dots \dots (1)\end{aligned}$$

In Equation 1, y is the annual growth rate of real GDP per capita; PDS is public debt service; I is investment; L is labour; FB is fiscal balance; TOP is trade openness; S is savings; TOT is terms of trade; β_0 is the constant term; $\beta_1 - \beta_8$ are the short-run regression coefficients; $\phi_1 - \phi_8$ are the long-run regression coefficients; Δ is the difference operator; n is the lag length; μ_{1t} is the white-noise error term; t is the time period.

When a long-run association exists between public debt service and economic growth, the error correction model (ECM) in an ARDL framework is expressed as follows:

$$\begin{aligned}\Delta y_t = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta y_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta PDS_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta I_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta L_{t-i} \\ & + \sum_{i=0}^n \beta_{5i} \Delta FB_{t-i} + \sum_{i=0}^n \beta_{6i} \Delta TOP_{t-i} + \sum_{i=0}^n \beta_{7i} \Delta S_{t-i} + \sum_{i=0}^n \beta_{8i} \Delta TOT_{t-i} \\ & + \omega_1 ECM_{t-1} + \mu_{2t} \dots \dots \dots (2)\end{aligned}$$

Where ω_2 is a regression coefficient; ECM_{t-1} is the one period lagged error-correction term; and all other variables and parameters are as defined in equation 1.

V Empirical analysis

In this segment, the study first performs unit root tests to ascertain the order of integration of all regression variables. The study uses three tests, namely, the Phillips-Perron (PP), the Perron (1997) (PPURoot), and the Dickey-Fuller Generalised Least Square (DF-GLS). The unit root test results are given in Table 1.

Table 1: Stationarity test results for all regression variables

	Stationarity of variables in levels						Stationarity of variables in first difference					
Variable	PP		PPURoot		DF-GLS		PP		PPURoot		DF-GLS	
	<i>Without trend</i>	<i>With trend</i>	<i>Without trend</i>	<i>With trend</i>	<i>Without trend</i>	<i>With trend</i>	<i>Without trend</i>	<i>With trend</i>	<i>Without trend</i>	<i>With trend</i>	<i>Without trend</i>	<i>With trend</i>
y	-5.592***	-6.116***	-6.831***	-6.917***	-3.295***	-6.219***	-	-	-	-	-	-
PDS	-1.752	-3.673**	-4.590	-4.614	-1.757	-3.739	-13.435***	-	-6.444***	-6.368***	-8.682***	-8.744***
I	-1.065	-1.436	-6.979***	-6.865***	-1.078	-1.394	-6.576***	-6.819***	-	-	-6.476***	-6.771***
L	-1.702	-0.164	-3.860	-3.668	-1.615	-2.039	-5.930***	-7.617***	-5.361*	-5.480*	-1.866*	-2.900*
FB	-3.302**	-5.204***	-5.802**	-8.534***	-3.267***	-5.167***	-	-	-	-	-	-
TOP	-2.888**	-2.999	-3.084	-3.292	-2.045**	-2.874	-	-10.254***	-6.812***	-6.787***	-	-6.307***
S	-2.714*	-2.862	-4.864	-5.109	-1.538	-1.982	-	-10.161***	-8.906***	-9.087***	-5.953***	-7.935***
TOT	-3.532**	-3.272*	-6.897***	-7.717***	-1.513	-3.263**	-	-	-	-	-4.570***	-

*Note that: ***, ** and * signify rejection of the null hypothesis of the presence of a unit root at 1%, 5% and 10% significance levels, respectively.*

Source: Generated using Econometrics views 7 (E-views 7).

Based on the stationarity test results given in Table 1, it can be inferred that economic growth and fiscal balance are consistently integrated of order zero, whereas labour is consistently integrated of order one across all three tests of unit root. All other variables that were nonstationary in levels became stationary after first differencing, irrespective of the unit root test employed. The results, therefore, validate the use of the ARDL framework in the study.

The study proceeds to investigate the presence of cointegration relationships among variables in the model using the bounds F-statistic test. The null hypothesis that no long-run relationship exists between public debt service and economic growth is tested against the alternative hypothesis that a long-run relationship exists. The results of the bounds F-statistic test are presented in Table 2.

Table 2: Bounds F-statistic test results

Dependent variable	Function		F-statistic		Cointegration status	
y	F(y PDS, I, L, FB, TOP, S, TOT)		4.318***		Cointegrated	
Asymptotic critical values						
Pesaran <i>et al.</i> (2001: 300)	1%		5%		10%	
Table CI (iii) Case III	<i>I</i> (0)	<i>I</i> (1)	<i>I</i> (0)	<i>I</i> (1)	<i>I</i> (0)	<i>I</i> (1)
	2.96	4.26	2.32	3.50	2.03	3.13

Note: *** denotes significance at 1%.

Source: Generated using Microfit 5.01.

The cointegration test results presented in Table 2 show that the calculated F-statistic is higher than the upper critical value bound at 1% significance level. The F-statistic suggests the existence of a distinct long-run relationship between the variables in the economic growth-public debt service model. Following the estimation of the ARDL model and the use of AIC and BIC for optimal lag-length selection, the AIC based ARDL (1, 2, 3, 1, 2, 3, 3, 2) model was selected since it was more parsimonious compared to the BIC model. The long-run results (Equation 1) and the short-run results (Equation 2) are presented in Table 3 Panels A and B, respectively.

Table 3: Long-run and short-run coefficients

Panel A: Long-run regression coefficients – Dependent variable is y			
Regressor	Coefficient	T-ratio	
C	-11.459	-0.960	
PDS	-0.200	-1.615	
I	0.255*	2.087	
L	0.090*	1.793	
FB	0.018	0.122	
TOP	-0.475***	-3.295	
S	0.556**	2.370	
TOT	-0.348	-0.631	
Panel B: Short-run regression coefficients – Dependent variable is Δy			
Regressor	Coefficient	T-ratio	
ΔPDS	-0.098*	-1.733	
ΔPDS1	-0.087	-0.713	
ΔI	-0.137	-0.965	
ΔI1	-0.300	-1.590	
ΔI2	0.113*	1.962	
ΔL	0.088	1.661	
ΔFB	0.105	1.011	
ΔFB1	0.261**	2.780	
ΔTOP	-0.161	-1.236	
ΔTOP1	0.277**	2.700	
ΔTOP2	0.236**	2.560	
ΔS	-0.021	-0.117	
ΔS1	-0.392*	-1.791	
ΔS2	-0.042	-0.234	
ΔTOT	0.707	1.649	
ΔTOT1	0.065	0.104	
ECM (-1)	-0.249***	-4.807	
R-squared	0.822	F-statistic	3.460[0.005]
R-bar-squared	0.584	DW statistic	1.907
Panel C: ECM-ARDL diagnostic test results			
Serial Correlation: CHSQ (1)		0.006 [0.940]	
Functional Form: CHSQ (1)		1.603* [0.082]	
Normality: CHSQ (2)		0.004 [0.998]	
Heteroscedasticity: CHSQ (1)		0.022 [0.883]	

Notes: ***, ** and * signify statistical significance at the 1%; 5%; and 10%, respectively.

Source: Generated using Microfit 5.01.

The long-run empirical results presented in Table 3 Panel A reveal that the coefficient of public debt service (PDS) is statistically insignificant. This infers that public debt service

has a neutral long-run impact on the economic growth (y) process of Zambia. There are three possible explanations to this result. First, the financial outlays towards public debt payments may have been too little – due to inability to repay the loans – to create long-run crowding effect on economic growth in Zambia (see IMF, 2017b). Second, the debt relief initiatives may have implicitly reduced the public debt service costs such that they could not influence economic growth initiatives in this country. Finally, there are possibilities that the borrowed funds were put into productive sectors thereby enhancing the country's capacity to repay the loans without depressing economic growth.

It could be argued, however, that despite the insignificant long-run impact of public debt service on economic growth in Zambia, the public debt service costs have adversely affected social expenditures – such as health, education and other welfare programs (MOF, 2014). This is evidenced by the extension of public debt relief initiatives to this country by the creditor community during the period from 1990 to 2006 in a move meant to alleviate poverty (see IMF, 2005; 2001). This study finding is in line with other empirical results on the subject reported by Jalles (2011) and Pattillo *et al.* (2002), among others.

The long-run results of other variables presented in Panel A of Table 3 indicate that the coefficients of investment (I), labour (L) and savings (S) are positive and statistically significant as presumed. This insinuates that gross domestic investment, labour and gross domestic savings positively influence the rate of economic growth in Zambia in the long run. Against study expectation, the coefficient of trade openness (TOP) turned out to be negative and statistically significant at 1%. This finding, though contrary to expectations, is not unusual. Studies by Zanoligo (2017) and Adhikary (2011), among others, have shown evidence that points to a negative long-run association between trade openness and economic growth. Further, the study results reveal that fiscal balance (FB) and terms of trade (TOT) have no long-run impact on economic growth in Zambia.

The short-run results presented in Panel B of Table 3 indicate that the coefficient of public debt service (ΔPDS) is negative and is statistically significant, implying that an increase in public debt service in Zambia in the current period can lead to an economic decline in the short run. This finding suggests that the revenue base of Zambia is still narrow such that government debt payments adversely affect economic growth. The results further imply the need to expand both the industrial and export base of the country in order to comply with public debt service responsibilities without negatively affecting economic growth in the long run. The

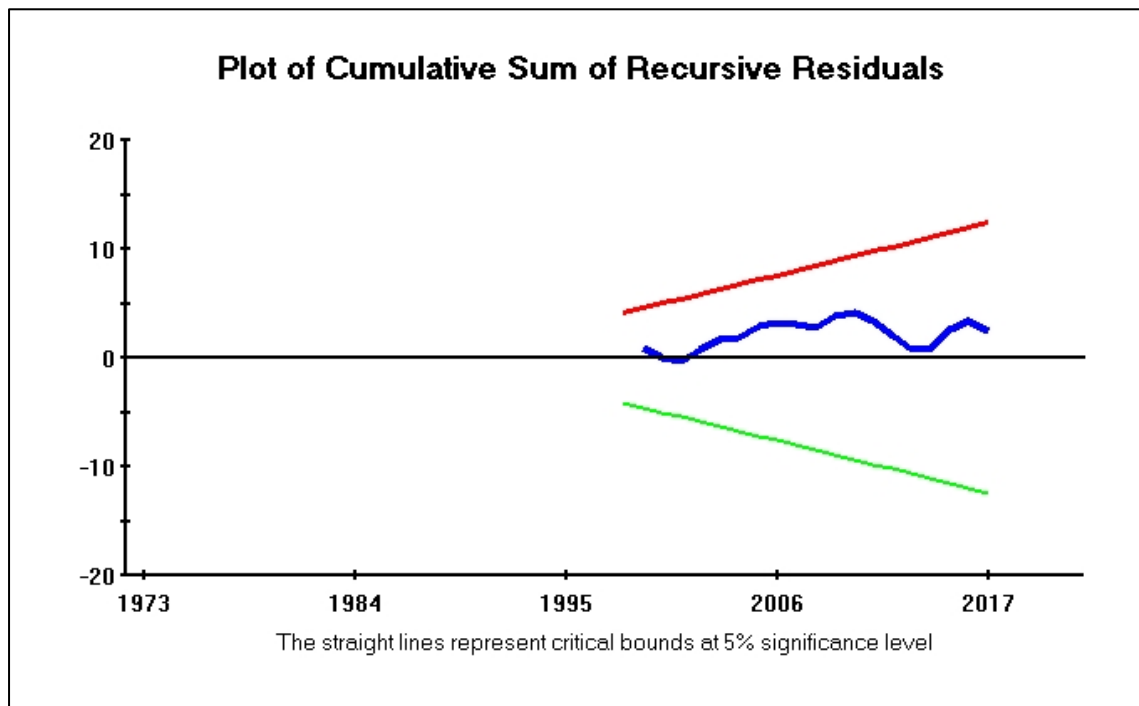
study findings compare favourably with the findings of Karagol (2002) and Hansen (2001), among others, on the subject.

Further, the short-run results presented in Panel B of Table 3 reveal that the coefficients of investment ($\Delta I(2)$), fiscal balance ($\Delta FB(1)$) and trade openness ($\Delta TOP(1)$ and $\Delta TOP(2)$) are positive and statistically significant. These results infer that investment, fiscal balance and trade openness in the past period have a positive impact on economic growth in the short run.

According to Barro (1979), the short-run positive impact of fiscal balance on economic growth could be through a positive effect of budget deficit on inflation and domestic public debt service cost. Thus, a combination of seignorage revenue, intensive control of domestic interest rates and significant inflationary effects in the Zambian economy in the 1980s and 1990s might have helped to reduce the value of domestic public debt, meaning also reduced overall debt repayment costs (see Sill, 2005; Hamburger and Zwick, 1981). Furthermore, the short-run coefficient of savings ($\Delta S(1)$) is unexpectedly negative and statistically significant at 10% significance level. This result suggests that savings ratio in the past period is negatively related to economic growth in the short run in Zambia. Lastly, as hypothesised, the error correction term $ECM(-1)$ is found to be negative and statistically significant at 1%, implying that in the event of a shock to the Zambian economy, economic growth adjusts to equilibrium at a rate of 24.9% per annum.

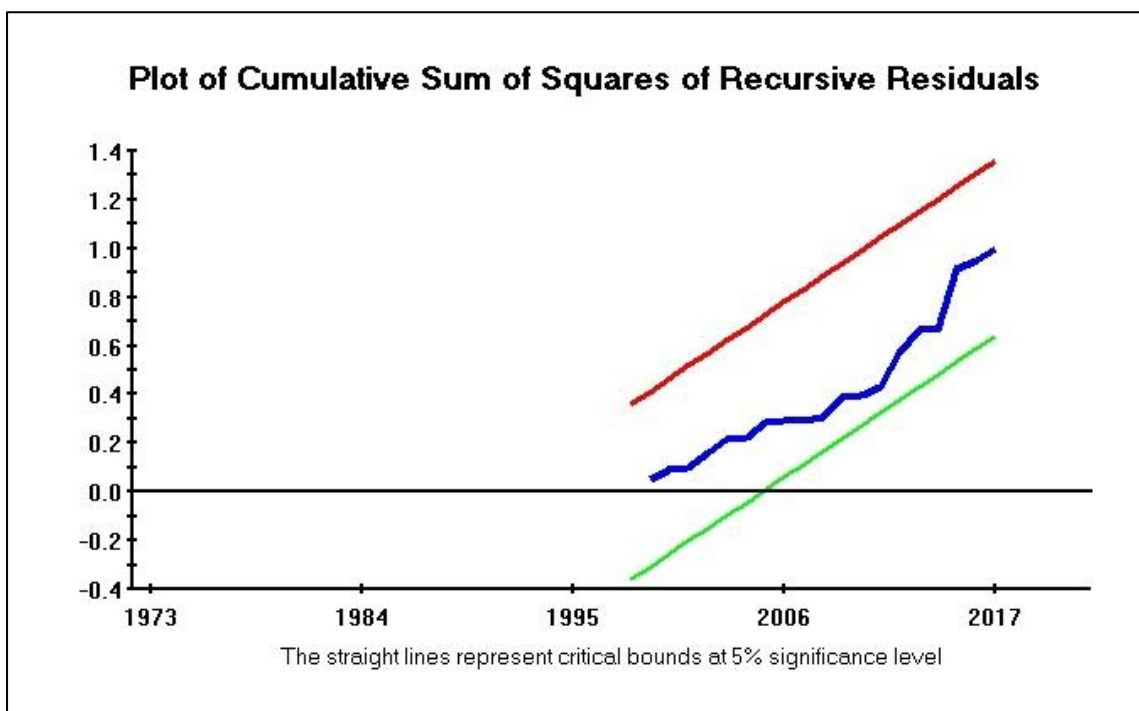
In Panel C of Table 3, the diagnostic test results show that the study model passed serial correlation, normality and heteroscedasticity tests but failed the test on functional form. Therefore, in order to confirm the robustness of the ARDL model, the study checked for the stability of the estimated parameters by applying the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests (see Brown *et al.*, 1975). The results are presented in Figures 2 and 3, respectively.

Figure 2: Cumulative sum of recursive residuals plot



Source: Generated using Microfit 5.01

Figure 3: Cumulative sum of squares of recursive residuals plot



Source: Generated using Microfit 5.01

Figure 2 and Figure 3 show that the CUSUM and CUMUMSQ plots are within the boundaries at 5% significance level, signifying that the study cannot reject the null hypothesis of model stability. This finding confirms the stability and robustness of the regression coefficients in this study.

VI Conclusion and policy suggestions

The net impact of public debt service on economic growth continues to be an open subject for debate among policy makers and academics. Even though the relationship between public debt and economic growth has received remarkable analyses in recent years, only a couple of studies have examined the impact of public debt service on economic growth. To contribute to the ongoing debt-growth debate, this paper investigated the impact of public debt service on economic growth in Zambia, employing a time-series method, covering the period 1970 – 2017. Zambia is among the lower-middle income countries in sub-Saharan Africa that received substantial public debt relief from its creditors between 1990 and 2006.

This study is among the first to empirically test the dynamic impact of public debt service on economic growth in Zambia. Applying the ARDL model, the empirical results reveal that the impact of government debt service on economic growth in Zambia is time-variant. Whereas the neutrality of public debt service on economic growth is confirmed in the long run, in the short run the relationship is negative. The study results further reveal that investment, labour and savings ratios are positively related to economic growth in Zambia in the long run. This finding is in line with both theoretical and empirical foundations that back this linkage. Finally, contrary to theoretical underpinnings and also to the study projections, though not unusual, trade openness is found to negatively affect economic growth in Zambia, in the long run.

The empirical evidence provided in this study suggests that new public debt in Zambia should be matched with an expansion of the production and export base of the country in order to comply with public debt service responsibilities. If the revenue base is thin, then taxes must rise to service total debt obligations which is strongly discouraged in this study. The results also imply that the government should limit its debt service to gross domestic product ratio to levels that are consistent with the pace of economic growth. Furthermore, since the impact of savings is negative and significant in the short run, the study strongly discourages the use of private savings to settle public debt obligations.

Additionally, the study recommends the undertaking of active fiscal consolidation to ensure that public debt repayments do not cause excessive budget overruns in the short run and are not financed from new debt. This is because borrowing to service previous debts puts the country's future economic competitiveness at risk since it creates tax uncertainties. The study further recommends the broadening of the domestic government revenue base by attracting long-term investments. Furthermore, the study subscribes to the continuous improvement of public debt management strategies and policies to smoothen the government's debt redemption profile.

Finally, sound domestic revenue and foreign exchange reserve management strategies should also be formulated by the responsible authorities to ensure that the country's liquid resources are adequate to meet debt repayments. This includes comprehensive government debt recording. The build-up of foreign exchange reserves can take the form of putting in legislature clauses that stipulate the depositing of a certain proportion of government's total revenue collections in a sinking fund on an annual basis. The proceeds of the sinking fund should then be used to pay-off Eurobonds and other foreign currency denominated debts in 2022 and afterwards when they fall due. This suggested initiative is a cautious way of minimising the risk of public debt service trap in Zambia beginning 2022.

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